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U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

Subject: Davis-Besse Nuclear Power Station
10 CFR 50.55a Request Regarding 48-Hour Hold Following J-Groove Nozzle Weld Repairs - Third Ten-Year Interval (RR-A31)

Ladies and Gentlemen:

Pursuant to 10 CFR 50.55a(a)(3)(i), the FirstEnergy Nuclear Operating Company (FENOC) requests Nuclear Regulatory Commission (NRC) approval of a proposed alternative (Request RR-A31) related to the 48-hour hold for nondestructive examinations following repairs on pressurizer J-groove nozzle welds at the Davis-Besse Nuclear Power Station (DBNPS). Enclosure 1 provides details of Request RR-A31.

FENOC requests approval of this proposed alternative by December 28, 2007 to allow installation of the pressurizer weld overlays during the next maintenance and refueling outage, which is currently scheduled to commence in December 2007.

As indicated in the attachment, there are no commitments included in this response. If there are any questions or if additional information is required, please contact Mr. Thomas A. Lentz, FENOC Manager - Fleet Licensing, at (330) 761-6071.

Very truly yours,

for Mark B. Bezilla

Mark B. Bezilla, Vice President-Nuclear

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NRR

Enclosure: FirstEnergy Nuclear Operating Company Davis-Besse Nuclear Power Station Third 10-Year Interval Request RR-A31

Attachment: Commitment List

cc: Regional Administrator, NRC Region III
NRC/NRR Project Manager
NRC Senior Resident Inspector
N. Dragani, Ohio Emergency Management Agency
Utility Radiological Safety Board

FIRSTENERGY NUCLEAR OPERATING COMPANY
DAVIS-BESSE NUCLEAR POWER STATION
THIRD 10-YEAR INTERVAL REQUEST RR-A31

PROPOSED ALTERNATIVE IN ACCORDANCE WITH 10 CFR 50.55a(a)(3)(i)

1. ASME Code Components Affected

Component Number:	1.5" or less Pressurizer J-Groove Nozzle Welds (Quantity 9)
Code Class:	Class 1
Examination Category:	N/A
Code Item Number:	N/A

2. Applicable Code Edition and Addenda

1995 Edition through the 1996 Addenda of ASME Section XI

3. Applicable Code Requirements

10 CFR 50.55a(b) approves the use of NRC Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," Revision 14. NRC Regulatory Guide 1.147 Revision 14 lists Code Case N-638-1, "Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique," as a Conditionally Acceptable Section XI Code Case.

Code Case N-638-1 Paragraph 4.0(b) states:

> "The final weld surface and the band around the area defined in para. 1.0(d) shall be examined using a surface and ultrasonic methods when the completed weld has been at ambient temperature for at least 48 hours. The ultrasonic examination shall be in accordance with Appendix I."

4. Reason for Request

Dissimilar metal welds made with nickel-based Alloy 82 and Alloy 182 weld material have been shown to be susceptible to primary water stress corrosion cracking (PWSCC) degradation in components such as the pressurizer that are subjected to higher operating temperatures. As a result, the FirstEnergy Nuclear Operating Company (FENOC) is proposing to take a proactive approach to repair vent, level sensing, sample and thermowell nozzles protruding from the pressurizer. These nozzles were installed utilizing J-groove welds applied on the interior surface of the pressurizer.

These nozzles will be repaired using a repair technique that installs an Alloy 52M weld pad on the outside surface of the pressurizer at each nozzle location. This pad will be applied in accordance with Code Case N-638-1. Industry experience has identified that commencing the 48-hour hold time after completion of the 3rd layer will improve efficiency and reduce personnel exposure.

5. Proposed Alternative and Basis for Use

Pursuant to 10 CFR 50.55a(a)(3)(i), FENOC proposes, as an alternative to the Code Case N-638-1 requirements stated above, to commence the 48-hour hold period after application of the 3rd layer of the weld pad overlay and use a 0.5-inch band adjacent to the weld for examination.

48-Hour Hold

The purpose of the 48-hour hold after the weldment has cooled to ambient temperature and the performance of the final nondestructive examinations (NDE) is to permit sufficient time for any hydrogen cracking to occur prior to the performance of the final NDE of the weldment.

Hydrogen cracking is a form of cold cracking. It is produced by the action of internal tensile stresses acting on low toughness heat affected zones. The internal stresses are produced from localized build-ups of monatomic hydrogen. Monatomic hydrogen forms when moisture or hydrocarbons interact with the welding arc and molten weld pool. The monatomic hydrogen can be entrapped during weld solidification and tends to migrate to transformation boundaries or other microstructure defect locations. As concentrations increase, the monatomic hydrogen will recombine to form molecular hydrogen – thus generating localized internal stresses at these internal defect locations. If these stresses exceed the fracture toughness of the material, hydrogen cracking will occur. This form of cracking requires the presence of hydrogen and low toughness materials. It is manifested by intergranular cracking of susceptible materials and normally occurs within 48 hours of welding.

Based on extensive research and industry experience, the Electric Power Research Institute (EPRI) has provided a technical basis for starting the 48-hour hold after completing the third temperbead weld layer rather than waiting for the weld overlay to cool to ambient temperature. This technical basis is documented in EPRI Report 1013558, *Temper Bead Welding Applications – 48-Hour Hold Requirements for Ambient Temperature Temper Bead Welding*. After evaluating the issues relevant to hydrogen cracking such as microstructure of susceptible materials, availability of hydrogen, applied stresses, temperature, and diffusivity and solubility of hydrogen in steels, EPRI concluded the following on page 5-2 of the report: "There appears to be no technical basis for waiting the 48 hours after cooling to ambient temperature before beginning the NDE of the completed weld. There should be no hydrogen present, and even if it were present, the temper bead welded component should be very tolerant of the moisture." Page 5-2 of the report also notes that over 20 weld overlays and 100 repairs have been performed over the last 20 years. During this time, there has never been an indication of

hydrogen cracking by the nondestructive examination performed after the 48-hour hold or by subsequent inservice inspection.

Although the technical data provided by EPRI in their report is based on testing performed on SA-508 Class 2 low alloy steels and other P-Number, Group 3 materials, the conclusions are bounding and applicable to P-Number 1 materials which have a lower carbon equivalent and lower hardenability. The Davis-Besse pressurizer shell and upper head are manufactured from SA-516 Grade 70 material which is P-Number 1 material.

In addition, the ASME Section XI Committee approved Revision 4 to Code Case N-638 (N-638-4) in October 2006 to allow the 48-hour hold to begin after completing the third weld layer when using austenitic filler metals. Paragraph 4(a)(2) of the code case states in part: "When austenitic materials are used, the weld shall be nondestructively examined after the three tempering layers (i.e., layers 1, 2, and 3) have been in place for at least 48 hours." The ASME Section XI technical basis for this change is documented in the ASME White Paper for Code Case N-638-4 (ADAMS Accession No. ML070790679). The ASME White Paper points out that introducing hydrogen to the heat-affected zone (HAZ) is limited to the first weld layer since this is the only weld layer that makes contact with the base material. While the potential for introducing hydrogen to the HAZ is negligible during subsequent layers, these layers provide a heat source that accelerates the dissipation of hydrogen from the HAZ in non-water backed applications. For water-backed applications, the base material acts as an infinite heat sink during welding which contributes to a moderate HAZ temperature, which effectively enables "time at ambient temperature" to occur while the fourth and subsequent layers are applied. Furthermore, since austenitic filler materials have a much greater affinity for hydrogen than carbon steel base materials, hydrogen can be assumed to move rapidly away from the HAZ through the austenitic material matrix, further reducing chances of HAZ cracking. The ASME White Paper determines that there is sufficient delay time to facilitate detecting potential hydrogen cracking when NDE is performed 48 hours after completing the third weld layer.

The liquid penetrant and ultrasonic NDE examinations required by 4.0(b) of Code Case N-638-1 are capable of detecting hydrogen cracking in ferritic materials. If hydrogen cracking were to occur, it would occur in the HAZ of the ferritic base material either below or immediately adjacent to the weld overlay. Therefore, it is unnecessary to examine the entire 1.5T band defined 1.0(d) of Code Case N-638-1. Instead, FENOC intends to examine the 0.5-inch band immediately adjacent to the weld. Hydrogen cracking is not a concern in austenitic materials. If it occurs in the ferritic base material below the weld overlay, it would be detected by the ultrasonic examination which will interrogate the entire weld overlay including the interface and HAZ beneath the weld overlay. If it occurs in the ferritic base material immediately adjacent to the weld overlay, it will be detected by the liquid penetrant examination, which is performed at least ½ inch on each side of the weld overlay. To provide sufficient time for hydrogen cracking to occur, the liquid penetrant and ultrasonic examinations will not be performed until at least 48 hours after completing the third layer of the weld overlay.

6. Conclusion

Beginning the 48-hour hold after completion of the third weld layer will not have a negative impact on the pressurizer. As described in the aforementioned EPRI report, based on the absence of hydrogen and tolerance of the temperbead material, there is no apparent technical basis for waiting 48 hours after the weld has reached ambient temperature before performing NDE. Accordingly, the use of the alternative provides an acceptable level of quality and safety as required by 10 CFR 50.55a(a)(3)(i).

7. Duration of Proposed Alternative

This proposed alternative will be utilized through the remainder of the third inspection interval, which ends on September 20, 2012.

8. Precedents

The following precedent demonstrates previous NRC acceptance of the proposed modification to Code Case N-638-1.

1. Letter from David Terao, NRC, to Timothy G. Mitchell, Entergy Operations, Inc., "Arkansas Nuclear One, Unit 1 – Request for Alternative ANO1-R&R-010 to Use Proposed Alternative to the American Society of Mechanical Engineers Boiler and Pressure Vessel Code Requirements for Pressurizer Nozzle Weld Overlay Repairs (TAC No. MD4019)," dated April 6, 2007.

9. References

1. ASME Section XI, 1995 Edition through the 1996 Addenda

2. NRC Regulatory Guide 1.147, Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1, Rev. 14

3. Code Case N-638-1, Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique, Section XI, Division 1

4. Code Case N-638-4, Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique, Section XI, Division 1

5. EPRI Report GC-111050, Ambient Temperature Preheat for Machine GTAW Temperbead Applications

6. EPRI Report 1013558, Repair and Replacement Applications Center: Temper Bead Welding Applications – 48-Hour Hold Requirements for Ambient Temperature Temper Bead Welding

7. RRA 05-08 Technical Basis Paper, N-638-x, Ambient Temperature Temperbead Welding: Begin 48 Hour Hold After 3rd Layer Completion, dated 06/18/06

COMMITMENT LIST

The following list identifies those actions committed to by the FirstEnergy Nuclear Operating Company (FENOC) in this document. Any other actions discussed in the submittal represent intended or planned actions by FENOC. They are described only for information and are not regulatory commitments. Please contact Mr. Thomas A. Lentz, FENOC Manager - Fleet Licensing at (330)761-6071, with any questions regarding this document or associated regulatory commitments.

COMMITMENTS	DUE DATE
None	N/A